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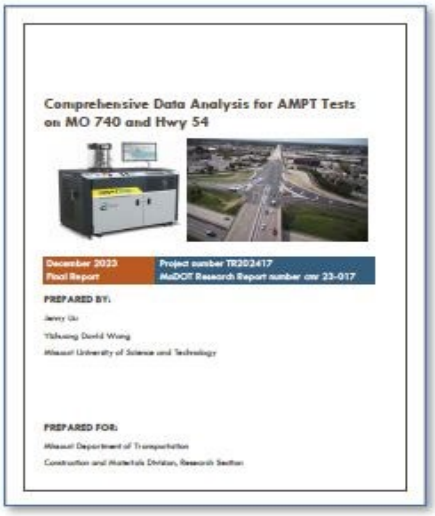
Research Summary

Comprehensive Data Analysis for AMPT Tests on MO 740 and Hwy 54



The Missouri Department of Transportation (MoDOT) has required contractors to fabricate and submit Asphalt Mixture Performance Tester (AMPT) samples for performance testing as per Standards NJSP2001 and NJSP2108. Recently, the samples collected from the Highway 54 and MO 740 resurfacing projects were tested by MoDOT and the Missouri University of Science and Technology (S&T), respectively. While the MO 740 project in Boone County contained test sections with five mix designs, i.e., control mix, ground tire rubber (GTR)-modified mixture, and three mixtures containing recycled plastic (polyethylene or PE), the Highway 54 project had ten samples collected at different times during the production of the overlay.

In this study, the S&T research team conducted comprehensive data analysis on the laboratory testing data. The data was analyzed on both the material and structural scales. For the MO 740 project, field performance was also used to verify the research findings. On the material level, the fundamental material properties such as the dynamic modulus master curve, the ViscoElastic Continuum Damage (VECD) fatigue model, and the Shift rutting model parameters of the testing materials were obtained. Additionally, the material fatigue and rutting resistance indices, i.e., Sapp and the Rutting Strain Index (RSI), were determined respectively in respect to the local Missouri climate conditions. The evaluation results were compared and correlated with the testing results from other performance testing methods. On the structural level, the fundamental material properties and the model coefficients were used to conduct the structural performance prediction in FlexPAVE™ with in-situ traffic volume and climate data. The performance deterioration of the pavement sections with respect to fatigue cracking was predicted as a function of service time. For the Highway 54 project testing data, the predicted performance was correlated with the measured volumetric-based acceptance quality characteristics (AQCs).

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The research found that in the Highway 54 project the variability in production was well controlled in an acceptable range, according to the dynamic modulus and fatigue testing results. The performance-volumetric relationship (PVR) was successfully applied to the Highway 54 mixture. Using the PVR, the fatigue performance of mixtures produced for other sublots can be predicted once the volumetric information is measured during quality assurance (QA). In terms of the five mixtures used in the MO 740 project, the AMPT tests suggested that the GTR-modified mixture had the lowest modulus but

also had the highest cracking resistance. However, the mixture might have a higher rutting susceptibility than the other mixtures. On the other hand, the addition of PE increased the mixture stiffness and did not have a great impact on the fatigue and rutting performance comparing with the control mix.

The field performance of the test sections on the Stadium Boulevard (MO 740) in Columbia, MO was extracted in this study. After eliminating the effects of field factors such as the traffic direction, it was found that the same trend was provided by the AMPT cyclic fatigue test and the IDEAL-CT cracking test.

The following recommendations were made based on the findings in the report:

- The volumetric parameters of asphalt mixtures can be strong indicators of their performance. For future AMPT projects, testing samples are compacted at different air void levels to increase their range of variation.
- The data collected from the MO 740 project showed that there were some differences between the observed field performance and the expected performance based on the laboratory testing results. This observation also highlighted the importance of conducting field tests. To apply new paving materials in the future, well-controlled field trial sections can be constructed, and sufficient mixture samples can be collected and stored so that laboratory tests using different testing methods and equipment can be conducted.
- AMPT performance tests and their corresponding multi-scale models can capture not only the material performance, but also their fundamental material properties. The pavement life can be predicted accordingly.

Project Information

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